

DATA SHEET

NEC

NPN SILICON RF TRANSISTOR 2SC5656

NPN SILICON RF TRANSISTOR FOR HIGH-FREQUENCY LOW NOISE 3-PIN NON-LEAD MINIMOLD

FEATURES

- 1006 package employed ($1.0 \times 0.6 \times 0.5$ mm)
- $NF = 1.3$ dB TYP., $|S_{21e}|^2 = 10.0$ dB TYP. @ $V_{CE} = 1$ V, $I_C = 5$ mA, $f = 2$ GHz

ORDERING INFORMATION

Part Number	Quantity	Supplying Form
2SC5656	50 pcs (Non reel)	• 8 mm wide paper carrier taping • Pin 3 (collector) face the perforation side of the tape
2SC5656-T1	10 kpcs/reel	

Remark To order evaluation samples, consult your NEC sales representative.
Unit sample quantity is 50 pcs.

ABSOLUTE MAXIMUM RATINGS ($T_A = +25^\circ\text{C}$)

Parameter	Symbol	Ratings	Unit
Collector to Base Voltage	V_{CBO}	15	V
Collector to Emitter Voltage	V_{CEO}	6	V
Emitter to Base Voltage	V_{EBO}	2	V
Collector Current	I_C	35	mA
Total Power Dissipation	P_{tot}^{Note}	150	mW
Junction Temperature	T_j	150	$^\circ\text{C}$
Storage Temperature	T_{stg}	-65 to +150	$^\circ\text{C}$

Note Mounted on $1.08 \text{ cm}^2 \times 1.0$ mm (t) glass epoxy substrate

Because this product uses high-frequency technology, avoid excessive static electricity, etc.

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.
Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

ELECTRICAL CHARACTERISTICS (T_A = +25°C)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
DC Characteristics						
Collector Cut-off Current	I _{CBO}	V _{CB} = 5 V, I _E = 0 mA	—	—	200	nA
Emitter Cut-off Current	I _{EBO}	V _{BE} = 1 V, I _C = 0 mA	—	—	200	nA
DC Current Gain	h _{FE} ^{Note 1}	V _{CE} = 1 V, I _C = 5 mA	60	—	120	—
RF Characteristics						
Gain Bandwidth Product	f _T	V _{CE} = 1 V, I _C = 5 mA, f = 2 GHz	12.0	13.5	—	GHz
Insertion Power Gain	S _{21e} ²	V _{CE} = 1 V, I _C = 5 mA, f = 2 GHz	8.5	10.0	—	dB
Noise Figure	NF	V _{CE} = 1 V, I _C = 5 mA, f = 2 GHz, Z _S = Z _{opt}	—	1.3	2.5	dB
Reverse Transfer Capacitance	C _{re} ^{Note 2}	V _{CB} = 1 V, I _E = 0 mA, f = 1 MHz	—	0.25	0.3	pF

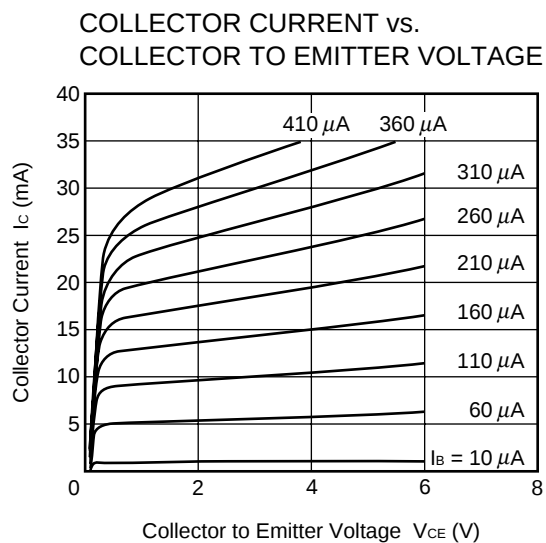
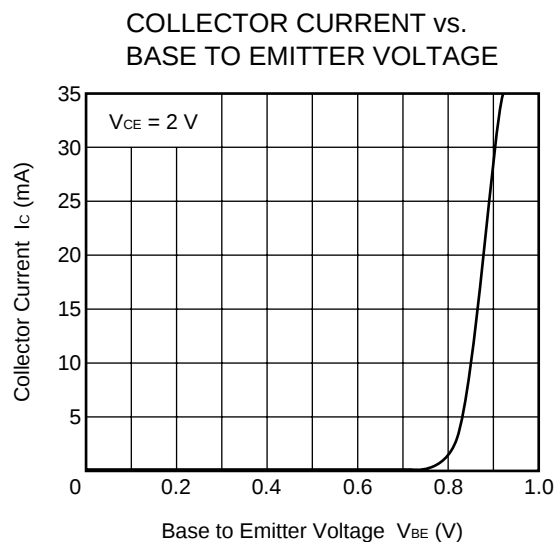
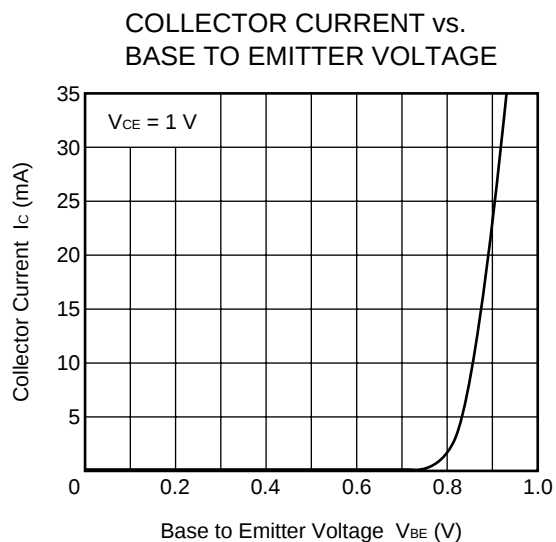
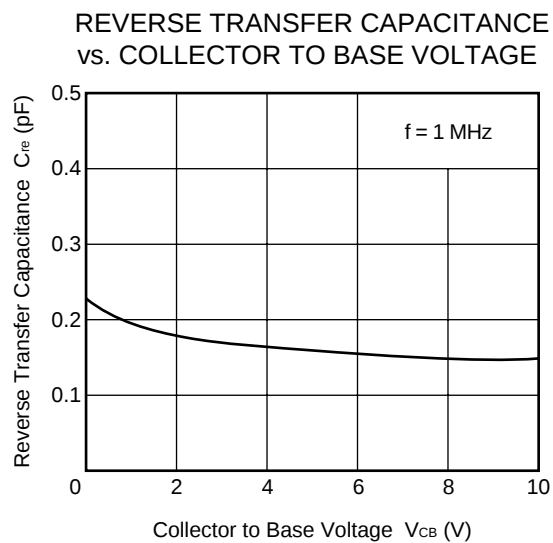
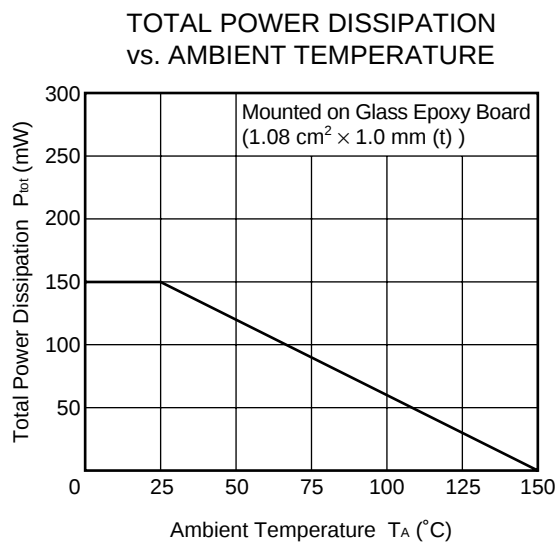
Notes 1. Pulse measurement: PW ≤ 350 μs, Duty Cycle ≤ 2%

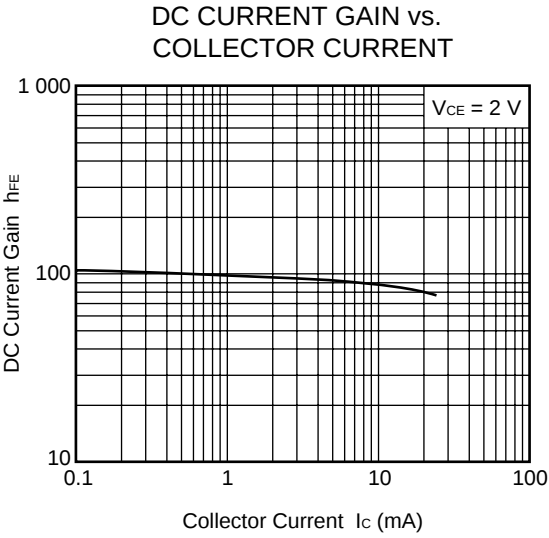
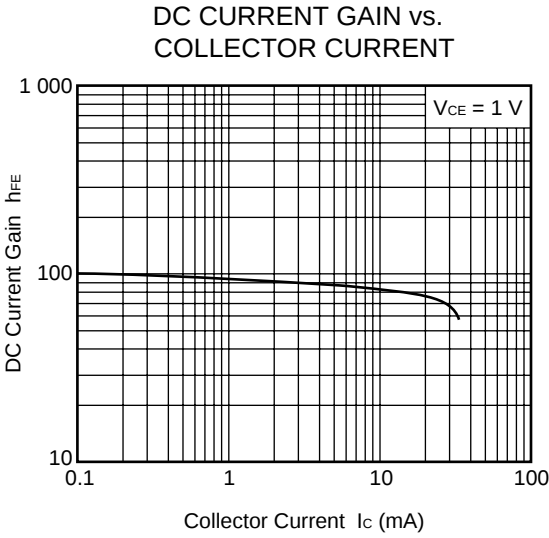
2. Collector to base capacitance measured using capacitance meter (self-balancing bridge method) when the emitter is connected to the guard pin

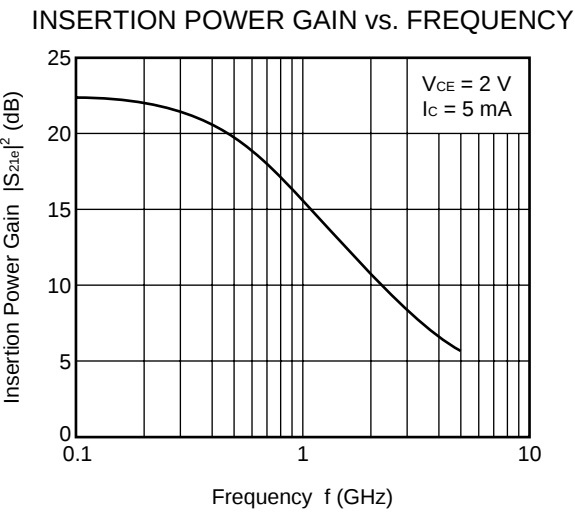
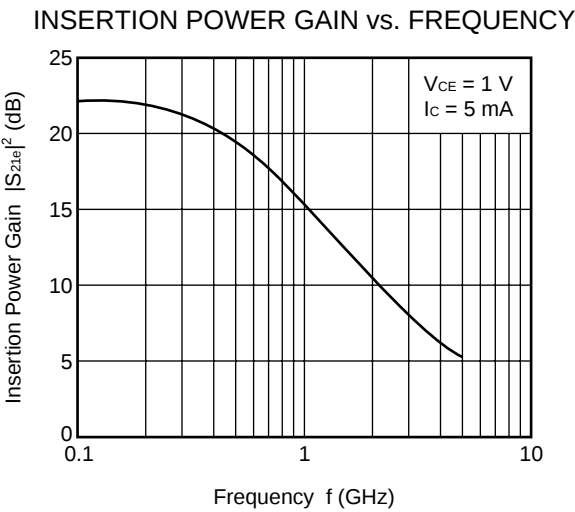
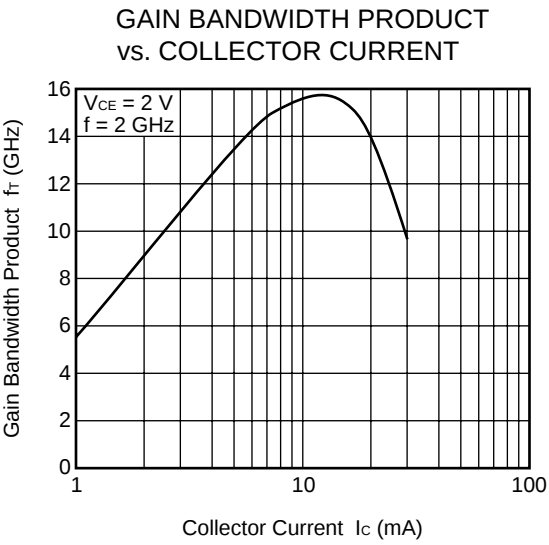
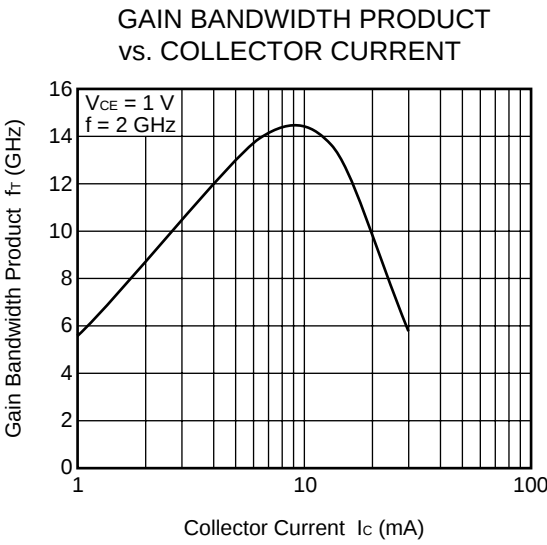
h_{FE} CLASSIFICATION

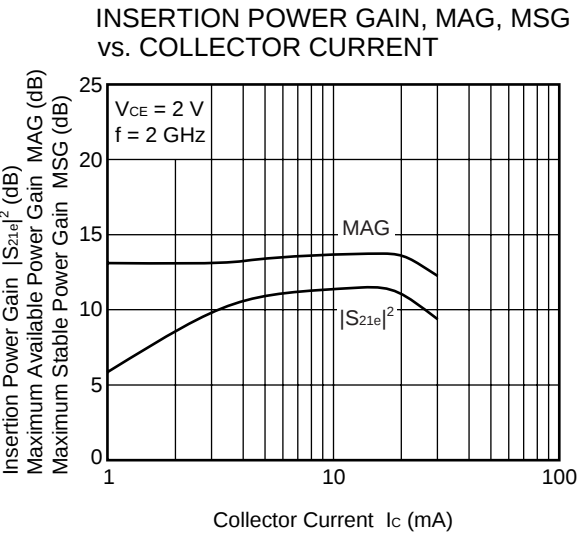
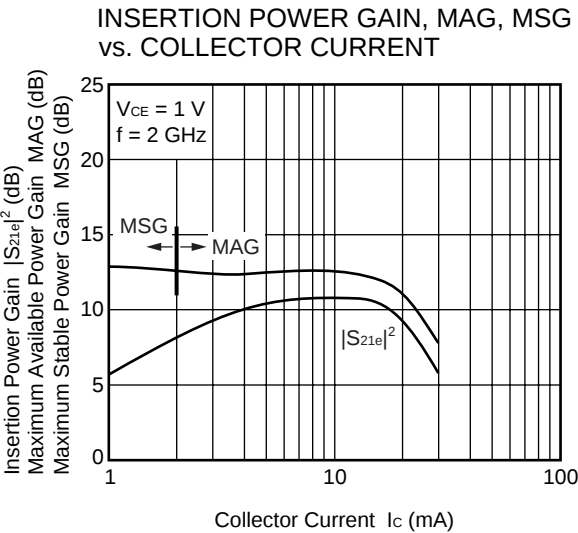
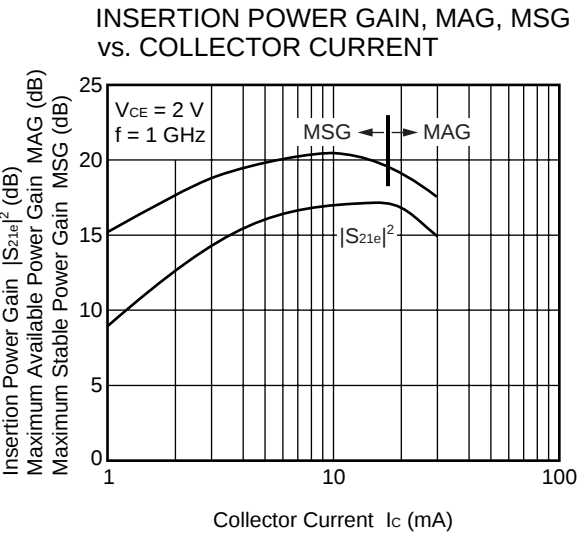
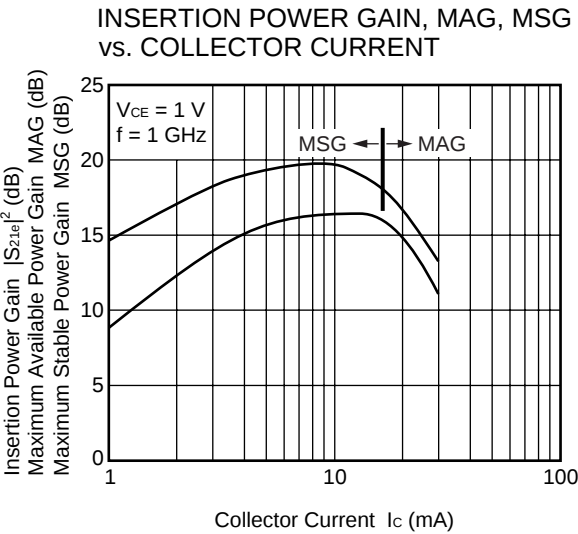
Rank	FB
Marking	L
h _{FE} Value	60 to 120

TYPICAL CHARACTERISTICS (Unless otherwise specified, $T_A = +25^\circ\text{C}$)

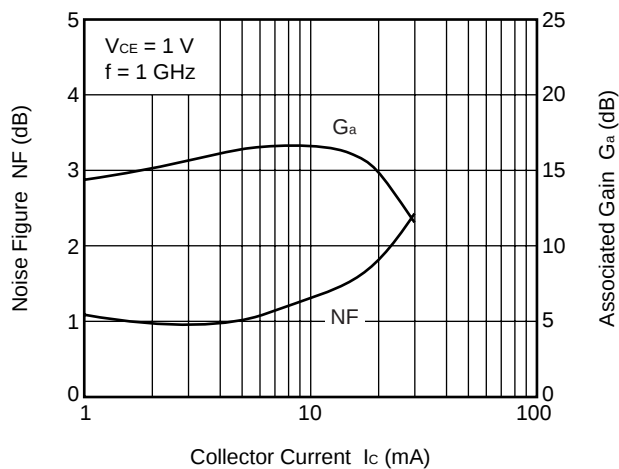




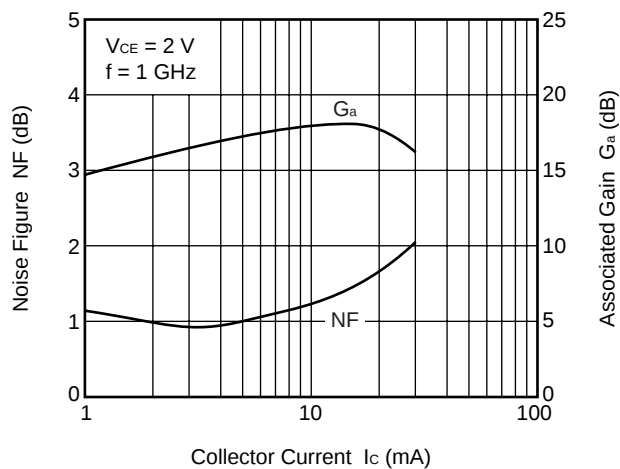




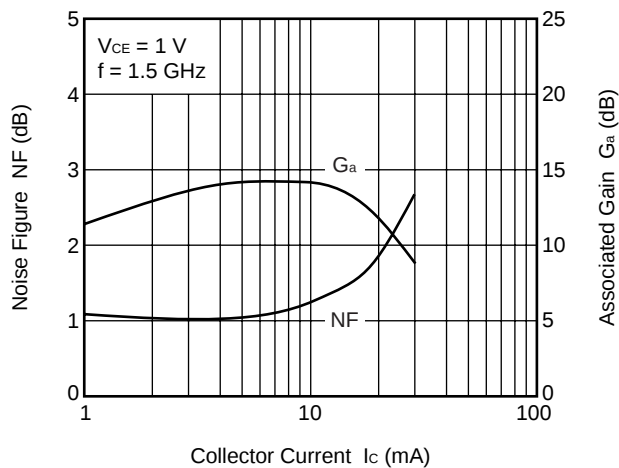
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



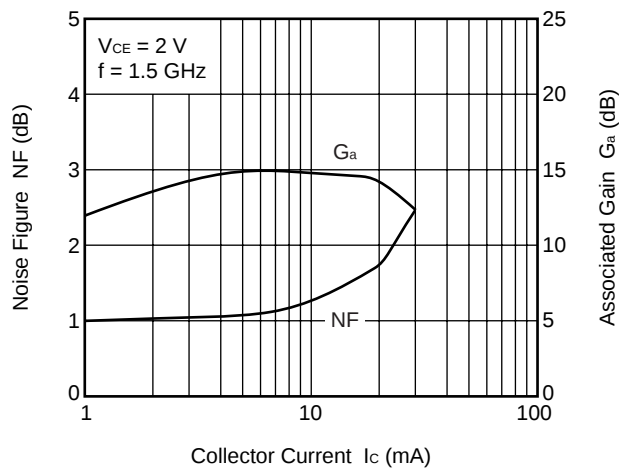
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



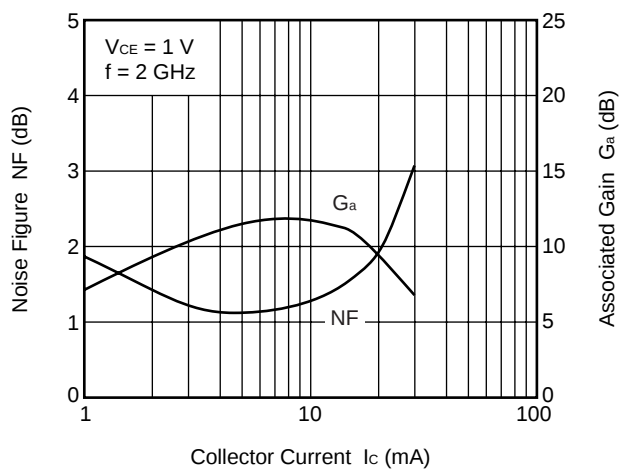
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



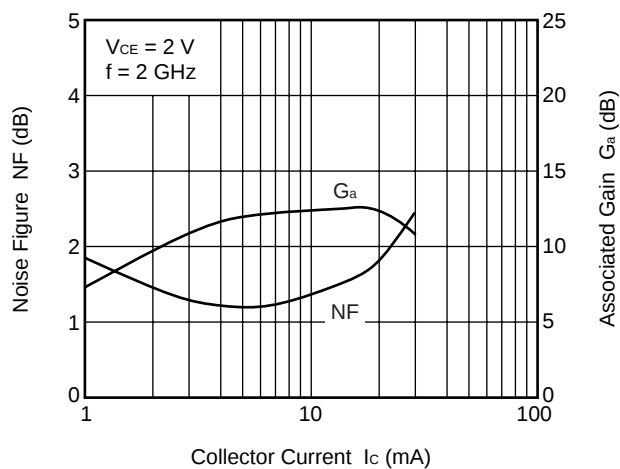
NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



NOISE FIGURE, ASSOCIATED GAIN
vs. COLLECTOR CURRENT



Remark The graphs indicate nominal characteristics.

S-PARAMETERS

Note When $K \geq 1$, the MAG (Maximum Available Gain) is used. $MAG = \left| \frac{S_{21}}{S_{12}} \right| (K - \sqrt{K^2 - 1})$

When $K < 1$, the MSG (Maximum Stable Gain) is used. $MSG = \left| \frac{S_{21}}{S_{12}} \right|$

$V_{CE} = 1 \text{ V}$, $I_C = 1 \text{ mA}$, $Z_0 = 50 \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG ^{Note} (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.959	-5.3	3.442	174.7	0.015	84.1	0.995	-4.4	0.060	23.52
0.2	0.945	-12.3	3.490	167.3	0.027	80.6	0.985	-8.8	0.079	21.15
0.3	0.939	-18.1	3.449	160.9	0.040	76.0	0.971	-13.1	0.125	19.34
0.4	0.919	-23.7	3.336	154.5	0.051	71.7	0.953	-17.4	0.167	18.13
0.5	0.896	-29.5	3.270	148.6	0.062	67.6	0.931	-21.5	0.206	17.24
0.6	0.873	-34.9	3.190	142.6	0.071	64.0	0.908	-25.4	0.249	16.52
0.7	0.846	-39.6	3.069	137.3	0.079	60.6	0.883	-29.1	0.295	15.88
0.8	0.821	-44.4	2.948	132.5	0.086	57.7	0.858	-32.6	0.330	15.36
0.9	0.796	-48.8	2.842	127.6	0.091	54.9	0.835	-35.9	0.376	14.95
1.0	0.772	-53.1	2.736	122.9	0.095	52.8	0.812	-38.8	0.421	14.59
1.1	0.748	-56.8	2.637	118.7	0.098	50.8	0.788	-41.8	0.472	14.30
1.2	0.725	-60.7	2.549	114.8	0.100	49.2	0.769	-44.5	0.515	14.06
1.3	0.703	-64.0	2.454	111.0	0.101	48.3	0.750	-47.0	0.567	13.83
1.4	0.682	-67.0	2.368	107.5	0.102	47.4	0.733	-49.2	0.622	13.65
1.5	0.665	-70.1	2.283	104.0	0.102	47.0	0.717	-51.3	0.674	13.48
1.6	0.646	-72.9	2.207	100.7	0.102	47.1	0.702	-53.4	0.734	13.34
1.7	0.629	-75.6	2.145	97.6	0.102	47.6	0.689	-55.1	0.791	13.24
1.8	0.611	-78.0	2.076	94.6	0.101	48.5	0.677	-56.9	0.855	13.12
1.9	0.595	-80.3	2.027	91.9	0.101	50.0	0.662	-58.6	0.917	13.04
2.0	0.578	-82.7	1.969	89.0	0.101	52.1	0.648	-60.2	0.985	12.92
2.1	0.564	-85.3	1.919	86.3	0.100	54.5	0.635	-61.7	1.045	11.53
2.2	0.550	-86.9	1.880	83.6	0.101	57.8	0.622	-63.3	1.098	10.80
2.3	0.535	-88.9	1.856	80.9	0.101	61.3	0.611	-64.8	1.141	10.35
2.4	0.523	-91.2	1.827	78.4	0.103	65.0	0.597	-66.6	1.176	9.95
2.5	0.510	-93.2	1.790	76.0	0.106	68.5	0.584	-68.4	1.209	9.53
2.6	0.495	-95.3	1.755	73.6	0.110	72.6	0.570	-70.7	1.231	9.14
2.7	0.483	-97.7	1.724	71.1	0.115	76.1	0.558	-73.0	1.232	8.86
2.8	0.468	-99.9	1.701	68.6	0.122	79.5	0.550	-74.9	1.210	8.68
2.9	0.456	-102.5	1.681	65.9	0.130	82.2	0.537	-76.9	1.189	8.47
3.0	0.444	-105.0	1.659	64.0	0.140	84.9	0.523	-79.8	1.159	8.31
4.0	0.408	-138.2	1.424	40.2	0.305	86.9	0.455	-114.9	0.805	6.70
5.0	0.474	-165.7	1.215	20.8	0.498	68.6	0.403	-163.9	0.741	3.87

$V_{CE} = 1\text{ V}$, $I_C = 3\text{ mA}$, $Z_o = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.896	-8.3	8.778	170.8	0.013	85.7	0.983	-6.7	0.062	28.46
0.2	0.855	-18.5	8.705	160.0	0.026	79.0	0.954	-13.1	0.158	25.29
0.3	0.822	-27.1	8.249	151.0	0.037	73.0	0.912	-18.8	0.242	23.52
0.4	0.768	-34.6	7.706	142.7	0.046	68.6	0.866	-23.9	0.324	22.22
0.5	0.724	-41.6	7.227	135.3	0.054	65.1	0.818	-28.5	0.392	21.27
0.6	0.676	-47.3	6.720	128.4	0.060	62.8	0.772	-32.1	0.468	20.46
0.7	0.632	-52.7	6.238	122.6	0.066	61.0	0.730	-35.2	0.534	19.74
0.8	0.592	-57.2	5.791	117.6	0.070	59.9	0.690	-38.0	0.603	19.16
0.9	0.560	-61.3	5.404	112.8	0.074	59.1	0.658	-40.2	0.663	18.61
1.0	0.529	-64.9	5.035	108.6	0.078	58.8	0.628	-42.1	0.726	18.10
1.1	0.499	-67.9	4.720	104.8	0.081	59.1	0.604	-43.9	0.785	17.65
1.2	0.478	-70.7	4.445	101.3	0.084	59.3	0.584	-45.3	0.834	17.23
1.3	0.456	-73.1	4.180	98.1	0.087	60.2	0.565	-46.5	0.885	16.80
1.4	0.437	-75.1	3.961	95.0	0.091	61.2	0.550	-47.6	0.929	16.41
1.5	0.420	-77.1	3.755	92.2	0.094	62.3	0.538	-48.6	0.965	16.02
1.6	0.405	-78.6	3.573	89.4	0.097	63.3	0.527	-49.4	1.002	15.37
1.7	0.392	-80.2	3.420	86.9	0.101	64.6	0.518	-50.1	1.028	14.28
1.8	0.381	-81.8	3.261	84.5	0.105	66.0	0.509	-50.6	1.051	13.54
1.9	0.369	-82.6	3.133	82.3	0.110	67.4	0.502	-51.2	1.070	12.94
2.0	0.358	-84.0	3.009	79.9	0.115	68.8	0.493	-51.7	1.084	12.42
2.1	0.350	-85.1	2.899	77.8	0.120	70.2	0.487	-52.3	1.093	11.98
2.2	0.339	-85.6	2.808	75.5	0.125	71.6	0.480	-53.0	1.100	11.58
2.3	0.332	-86.7	2.731	73.5	0.131	73.0	0.474	-53.5	1.096	11.30
2.4	0.325	-87.7	2.661	71.5	0.137	74.2	0.467	-54.2	1.096	11.00
2.5	0.315	-88.6	2.580	69.7	0.144	75.1	0.460	-55.2	1.098	10.64
2.6	0.308	-89.6	2.511	67.8	0.151	76.1	0.451	-56.3	1.095	10.34
2.7	0.301	-91.2	2.449	66.0	0.158	76.8	0.444	-57.9	1.088	10.09
2.8	0.293	-92.8	2.393	63.9	0.166	77.4	0.439	-59.0	1.076	9.90
2.9	0.288	-94.3	2.347	61.8	0.175	77.7	0.429	-60.4	1.065	9.71
3.0	0.279	-96.3	2.297	60.3	0.185	78.2	0.420	-62.6	1.052	9.55
4.0	0.276	-129.2	1.930	41.4	0.305	75.9	0.355	-90.8	0.890	8.02
5.0	0.378	-155.5	1.693	23.4	0.448	64.3	0.287	-130.6	0.792	5.77

$V_{CE} = 1\text{ V}$, $I_C = 5\text{ mA}$, $Z_O = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.825	-11.5	12.992	167.6	0.013	84.2	0.969	-8.4	0.119	30.07
0.2	0.773	-23.3	12.527	154.4	0.024	78.0	0.920	-16.2	0.228	27.23
0.3	0.718	-33.4	11.426	143.8	0.034	72.2	0.859	-22.4	0.337	25.22
0.4	0.650	-41.5	10.355	134.6	0.043	68.1	0.794	-27.5	0.447	23.86
0.5	0.594	-48.7	9.393	126.9	0.049	65.5	0.733	-31.5	0.536	22.84
0.6	0.542	-54.1	8.490	120.1	0.054	64.5	0.681	-34.3	0.620	21.93
0.7	0.499	-58.8	7.726	114.5	0.060	63.7	0.636	-36.5	0.695	21.11
0.8	0.460	-63.2	7.028	109.8	0.064	63.7	0.599	-38.4	0.760	20.38
0.9	0.428	-66.4	6.454	105.5	0.069	64.1	0.570	-39.8	0.819	19.72
1.0	0.402	-69.0	5.946	101.8	0.073	64.7	0.544	-40.8	0.872	19.10
1.1	0.379	-71.4	5.500	98.4	0.078	65.4	0.524	-41.9	0.917	18.51
1.2	0.364	-74.0	5.132	95.3	0.082	66.1	0.508	-42.7	0.950	17.97
1.3	0.345	-75.1	4.806	92.4	0.086	67.2	0.495	-43.2	0.985	17.45
1.4	0.332	-76.9	4.517	89.7	0.091	67.8	0.484	-43.9	1.009	16.35
1.5	0.319	-77.9	4.248	87.2	0.096	68.8	0.477	-44.4	1.032	15.36
1.6	0.310	-79.0	4.036	84.7	0.101	69.7	0.470	-44.8	1.046	14.70
1.7	0.300	-79.7	3.840	82.4	0.106	70.6	0.464	-45.1	1.059	14.09
1.8	0.292	-80.4	3.653	80.4	0.112	71.4	0.460	-45.5	1.069	13.54
1.9	0.286	-80.4	3.490	78.5	0.118	72.0	0.456	-45.9	1.074	13.06
2.0	0.281	-81.7	3.340	76.4	0.124	72.8	0.452	-46.2	1.077	12.62
2.1	0.275	-82.1	3.207	74.6	0.131	73.6	0.449	-46.6	1.076	12.22
2.2	0.269	-82.3	3.096	72.6	0.137	74.3	0.445	-47.1	1.076	11.86
2.3	0.265	-83.0	3.002	70.7	0.144	75.0	0.442	-47.4	1.070	11.58
2.4	0.259	-84.1	2.911	69.0	0.150	75.7	0.438	-48.0	1.068	11.28
2.5	0.255	-84.3	2.825	67.3	0.158	75.9	0.432	-48.8	1.064	10.99
2.6	0.250	-85.0	2.739	65.6	0.165	76.2	0.427	-49.9	1.061	10.69
2.7	0.243	-86.8	2.668	64.1	0.173	76.4	0.420	-51.0	1.056	10.44
2.8	0.240	-87.9	2.598	62.2	0.181	76.6	0.418	-52.1	1.047	10.25
2.9	0.237	-89.7	2.542	60.4	0.190	76.5	0.408	-53.4	1.038	10.06
3.0	0.231	-91.5	2.488	59.0	0.200	76.6	0.402	-55.6	1.028	9.94
4.0	0.236	-127.6	2.072	42.1	0.310	72.6	0.332	-81.9	0.912	8.25
5.0	0.340	-153.6	1.828	25.2	0.439	61.9	0.256	-116.6	0.829	6.20

$V_{CE} = 1\text{ V}$, $I_C = 7\text{ mA}$, $Z_O = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.763	-13.4	16.216	165.1	0.013	78.9	0.956	-9.8	0.225	31.03
0.2	0.700	-27.6	15.232	150.2	0.023	76.0	0.890	-18.3	0.304	28.19
0.3	0.632	-38.3	13.539	138.7	0.032	71.4	0.813	-24.7	0.423	26.21
0.4	0.561	-46.4	11.918	129.3	0.040	68.6	0.740	-29.3	0.539	24.77
0.5	0.501	-53.3	10.572	121.4	0.046	67.0	0.675	-32.6	0.638	23.63
0.6	0.455	-58.7	9.404	115.0	0.051	66.8	0.623	-34.7	0.719	22.63
0.7	0.412	-62.7	8.445	109.8	0.057	66.6	0.582	-36.2	0.790	21.72
0.8	0.378	-66.4	7.616	105.3	0.062	67.1	0.548	-37.6	0.851	20.92
0.9	0.349	-69.6	6.932	101.3	0.067	67.7	0.522	-38.4	0.899	20.16
1.0	0.330	-71.6	6.343	97.9	0.072	68.5	0.501	-39.0	0.941	19.46
1.1	0.311	-73.6	5.857	94.7	0.077	69.2	0.484	-39.8	0.975	18.83
1.2	0.299	-75.6	5.440	91.9	0.082	69.9	0.472	-40.2	0.998	18.22
1.3	0.284	-76.3	5.063	89.2	0.087	70.6	0.463	-40.7	1.023	16.71
1.4	0.276	-77.6	4.742	86.8	0.093	71.4	0.455	-41.1	1.037	15.90
1.5	0.265	-77.9	4.459	84.5	0.098	72.0	0.450	-41.5	1.052	15.17
1.6	0.261	-78.9	4.217	82.2	0.104	72.5	0.446	-41.9	1.060	14.58
1.7	0.254	-79.7	4.012	80.0	0.110	73.2	0.443	-42.1	1.063	14.09
1.8	0.246	-79.9	3.807	78.1	0.116	73.8	0.440	-42.3	1.071	13.54
1.9	0.241	-80.3	3.637	76.4	0.122	74.1	0.438	-42.7	1.070	13.11
2.0	0.240	-80.5	3.473	74.5	0.129	74.7	0.436	-42.9	1.070	12.68
2.1	0.238	-81.3	3.330	72.7	0.136	74.9	0.435	-43.3	1.066	12.31
2.2	0.233	-80.9	3.212	70.8	0.143	75.4	0.433	-43.8	1.063	11.97
2.3	0.230	-81.3	3.115	69.1	0.150	75.9	0.431	-44.2	1.058	11.70
2.4	0.228	-82.6	3.018	67.5	0.157	76.2	0.428	-44.7	1.052	11.44
2.5	0.222	-83.0	2.920	66.0	0.165	76.3	0.424	-45.6	1.050	11.12
2.6	0.219	-83.2	2.829	64.3	0.173	76.4	0.420	-46.6	1.046	10.83
2.7	0.218	-85.6	2.755	62.8	0.181	76.3	0.414	-47.8	1.038	10.64
2.8	0.212	-85.9	2.683	61.1	0.189	76.3	0.412	-48.9	1.033	10.42
2.9	0.210	-87.8	2.622	59.4	0.198	76.0	0.401	-50.2	1.027	10.21
3.0	0.205	-89.8	2.558	58.1	0.207	75.9	0.396	-52.4	1.018	10.09
4.0	0.217	-128.5	2.126	42.1	0.316	71.2	0.324	-78.2	0.917	8.28
5.0	0.329	-155.0	1.878	25.6	0.439	60.7	0.245	-110.8	0.840	6.31

$V_{CE} = 1\text{ V}$, $I_C = 10\text{ mA}$, $Z_O = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.695	-16.7	19.679	162.1	0.013	86.4	0.935	-11.5	0.180	31.80
0.2	0.610	-32.4	17.861	145.2	0.023	75.5	0.850	-20.5	0.386	28.98
0.3	0.537	-44.0	15.334	133.1	0.031	71.2	0.759	-26.5	0.520	26.96
0.4	0.462	-52.4	13.131	123.4	0.037	69.5	0.681	-30.4	0.643	25.45
0.5	0.410	-59.4	11.420	116.1	0.043	69.1	0.618	-32.8	0.738	24.26
0.6	0.364	-64.0	9.997	109.9	0.049	69.2	0.569	-34.1	0.818	23.11
0.7	0.329	-68.5	8.880	105.0	0.055	69.6	0.533	-35.0	0.875	22.11
0.8	0.300	-71.5	7.946	101.1	0.060	70.3	0.505	-35.8	0.925	21.21
0.9	0.279	-74.4	7.193	97.4	0.066	71.1	0.485	-36.3	0.961	20.40
1.0	0.264	-76.5	6.545	94.2	0.071	71.9	0.468	-36.7	0.993	19.63
1.1	0.250	-77.6	6.021	91.4	0.077	72.5	0.455	-37.1	1.018	18.13
1.2	0.241	-79.8	5.595	88.6	0.083	73.1	0.446	-37.8	1.029	17.26
1.3	0.230	-80.4	5.184	86.3	0.089	73.7	0.439	-37.8	1.048	16.34
1.4	0.224	-81.0	4.857	84.0	0.095	74.1	0.435	-38.3	1.054	15.68
1.5	0.217	-81.8	4.552	81.9	0.101	74.6	0.432	-38.8	1.063	15.02
1.6	0.211	-82.2	4.288	79.7	0.107	74.9	0.430	-39.2	1.069	14.43
1.7	0.208	-82.6	4.085	77.6	0.114	75.3	0.429	-39.5	1.066	14.00
1.8	0.206	-82.8	3.870	75.9	0.120	75.7	0.429	-39.7	1.066	13.51
1.9	0.203	-82.7	3.694	74.3	0.127	75.7	0.429	-40.2	1.063	13.09
2.0	0.200	-83.2	3.524	72.4	0.134	76.1	0.427	-40.5	1.063	12.66
2.1	0.199	-83.8	3.376	70.7	0.141	76.2	0.427	-40.9	1.060	12.29
2.2	0.197	-83.4	3.255	69.0	0.149	76.6	0.427	-41.5	1.053	11.99
2.3	0.196	-84.0	3.152	67.3	0.156	76.9	0.425	-42.0	1.045	11.75
2.4	0.193	-85.0	3.054	65.8	0.164	76.9	0.423	-42.6	1.040	11.48
2.5	0.193	-85.4	2.955	64.3	0.171	76.9	0.420	-43.5	1.036	11.20
2.6	0.190	-85.3	2.862	62.7	0.180	76.8	0.416	-44.5	1.033	10.92
2.7	0.188	-88.8	2.786	61.4	0.188	76.6	0.411	-45.8	1.024	10.76
2.8	0.184	-89.0	2.704	59.7	0.196	76.4	0.409	-46.9	1.021	10.51
2.9	0.181	-91.5	2.644	58.0	0.206	75.8	0.399	-48.4	1.015	10.35
3.0	0.175	-93.0	2.581	56.8	0.215	75.7	0.393	-50.6	1.008	10.25
4.0	0.207	-135.8	2.139	41.1	0.324	70.2	0.321	-76.8	0.912	8.19
5.0	0.324	-160.0	1.888	25.0	0.446	59.5	0.241	-109.0	0.844	6.26

$V_{CE} = 1\text{ V}$, $I_C = 20\text{ mA}$, $Z_O = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.509	-34.0	23.148	153.3	0.015	77.0	0.826	-15.8	0.443	32.00
0.2	0.405	-62.1	18.792	132.8	0.022	71.1	0.700	-25.3	0.618	29.29
0.3	0.344	-80.6	14.820	120.0	0.030	69.0	0.600	-29.4	0.760	26.98
0.4	0.299	-95.0	12.043	111.2	0.037	69.1	0.532	-31.1	0.865	25.15
0.5	0.274	-106.1	10.064	104.7	0.043	70.2	0.487	-31.8	0.943	23.70
0.6	0.253	-114.3	8.616	99.3	0.049	71.7	0.456	-32.0	1.006	22.00
0.7	0.237	-120.9	7.513	95.1	0.056	72.7	0.434	-32.5	1.044	20.01
0.8	0.230	-126.7	6.657	91.7	0.062	73.9	0.419	-32.9	1.074	18.65
0.9	0.224	-131.1	5.988	88.5	0.068	74.7	0.409	-33.4	1.093	17.56
1.0	0.215	-134.6	5.416	85.7	0.075	75.5	0.400	-34.2	1.112	16.53
1.1	0.211	-138.2	4.965	83.1	0.082	76.2	0.394	-35.0	1.121	15.71
1.2	0.209	-139.8	4.596	80.7	0.089	76.6	0.390	-35.9	1.124	14.99
1.3	0.203	-142.4	4.257	78.4	0.096	77.2	0.389	-36.7	1.128	14.29
1.4	0.197	-144.4	3.976	76.1	0.103	77.4	0.389	-37.6	1.128	13.67
1.5	0.194	-145.8	3.731	74.1	0.111	77.8	0.389	-38.5	1.124	13.12
1.6	0.191	-147.1	3.524	72.0	0.118	77.8	0.389	-39.4	1.120	12.63
1.7	0.190	-148.3	3.343	70.0	0.127	78.2	0.390	-40.3	1.108	12.21
1.8	0.185	-149.5	3.169	68.2	0.134	78.2	0.391	-41.0	1.107	11.74
1.9	0.181	-150.0	3.023	66.5	0.143	78.1	0.391	-42.0	1.099	11.34
2.0	0.179	-151.6	2.891	64.6	0.152	78.2	0.392	-42.8	1.088	10.99
2.1	0.180	-152.6	2.769	62.9	0.161	78.0	0.391	-43.7	1.079	10.65
2.2	0.174	-154.7	2.672	60.9	0.170	78.1	0.391	-45.0	1.067	10.38
2.3	0.173	-155.4	2.586	59.2	0.179	77.9	0.389	-45.9	1.056	10.14
2.4	0.174	-156.7	2.505	57.5	0.188	77.9	0.387	-47.0	1.047	9.92
2.5	0.173	-158.2	2.425	55.9	0.198	77.5	0.383	-48.6	1.040	9.65
2.6	0.169	-160.9	2.350	54.2	0.208	77.0	0.378	-50.2	1.033	9.40
2.7	0.177	-162.9	2.286	52.7	0.219	76.4	0.371	-52.2	1.022	9.28
2.8	0.174	-165.6	2.224	50.9	0.229	75.9	0.369	-54.1	1.016	9.11
2.9	0.179	-167.6	2.169	49.0	0.241	75.1	0.358	-56.4	1.007	9.05
3.0	0.181	-170.9	2.115	47.6	0.252	74.5	0.351	-59.3	0.998	9.24
4.0	0.292	168.7	1.722	30.7	0.378	65.5	0.277	-96.8	0.900	6.59
5.0	0.407	158.7	1.484	14.3	0.508	52.0	0.222	-147.3	0.851	4.65

$V_{CE} = 2\text{ V}$, $I_C = 1\text{ mA}$, $Z_0 = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.964	-5.5	3.380	175.1	0.013	83.7	0.996	-4.1	0.056	24.15
0.2	0.949	-11.6	3.451	167.7	0.023	81.5	0.987	-8.2	0.073	21.74
0.3	0.944	-17.2	3.402	161.6	0.035	76.7	0.974	-12.3	0.118	19.87
0.4	0.921	-22.4	3.301	155.5	0.045	72.4	0.957	-16.2	0.169	18.64
0.5	0.905	-28.0	3.240	149.6	0.054	68.4	0.939	-20.2	0.204	17.76
0.6	0.881	-33.0	3.161	144.0	0.063	65.2	0.917	-23.7	0.247	17.03
0.7	0.855	-37.6	3.054	138.7	0.070	61.9	0.896	-27.3	0.290	16.42
0.8	0.828	-42.4	2.945	134.0	0.075	59.2	0.871	-30.7	0.328	15.93
0.9	0.807	-46.6	2.845	129.3	0.080	56.6	0.850	-33.8	0.371	15.50
1.0	0.785	-50.7	2.735	124.6	0.084	54.5	0.828	-36.7	0.417	15.14
1.1	0.761	-54.3	2.644	120.5	0.086	52.7	0.807	-39.5	0.469	14.87
1.2	0.739	-58.2	2.562	116.7	0.088	51.3	0.787	-42.1	0.514	14.65
1.3	0.717	-61.4	2.473	112.9	0.089	50.4	0.769	-44.5	0.570	14.44
1.4	0.697	-64.5	2.389	109.4	0.089	49.8	0.754	-46.6	0.624	14.27
1.5	0.678	-67.2	2.307	106.0	0.089	49.7	0.738	-48.8	0.685	14.12
1.6	0.659	-69.9	2.232	102.7	0.089	50.0	0.724	-50.7	0.748	13.98
1.7	0.642	-72.5	2.165	99.6	0.088	50.8	0.711	-52.5	0.811	13.89
1.8	0.625	-75.0	2.100	96.6	0.088	52.2	0.699	-54.0	0.880	13.79
1.9	0.610	-77.2	2.049	94.0	0.087	54.2	0.685	-55.7	0.944	13.72
2.0	0.594	-79.3	1.990	91.1	0.087	57.0	0.673	-57.2	1.013	12.90
2.1	0.579	-81.9	1.945	88.5	0.087	60.3	0.661	-58.8	1.068	11.93
2.2	0.562	-83.4	1.910	85.6	0.087	64.1	0.649	-60.3	1.122	11.27
2.3	0.552	-85.4	1.882	83.0	0.089	68.3	0.638	-61.6	1.153	10.90
2.4	0.534	-87.4	1.852	80.6	0.091	72.8	0.626	-63.3	1.192	10.45
2.5	0.521	-89.3	1.818	78.2	0.094	77.0	0.612	-64.9	1.213	10.07
2.6	0.506	-91.4	1.783	75.8	0.099	81.5	0.600	-67.1	1.215	9.75
2.7	0.495	-93.3	1.757	73.4	0.106	85.5	0.589	-69.2	1.193	9.55
2.8	0.479	-95.5	1.731	70.9	0.114	88.9	0.581	-71.0	1.159	9.39
2.9	0.468	-98.0	1.712	68.2	0.124	91.6	0.568	-72.8	1.124	9.27
3.0	0.455	-100.5	1.695	66.3	0.135	94.0	0.555	-75.5	1.085	9.22
4.0	0.410	-132.1	1.471	42.6	0.310	93.2	0.488	-108.7	0.731	6.76
5.0	0.478	-160.3	1.260	22.5	0.513	73.0	0.423	-156.1	0.688	3.90

$V_{CE} = 2 \text{ V}$, $I_C = 3 \text{ mA}$, $Z_0 = 50 \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.894	-7.8	8.820	171.1	0.012	84.7	0.987	-6.2	0.081	28.66
0.2	0.861	-17.3	8.769	160.7	0.022	80.5	0.959	-11.9	0.145	25.95
0.3	0.829	-25.2	8.344	151.9	0.032	74.1	0.922	-17.2	0.243	24.11
0.4	0.782	-32.3	7.825	143.8	0.041	70.1	0.880	-21.9	0.319	22.85
0.5	0.736	-39.0	7.347	136.5	0.047	66.5	0.836	-26.1	0.392	21.91
0.6	0.692	-44.4	6.860	129.9	0.053	64.6	0.793	-29.4	0.463	21.09
0.7	0.648	-49.2	6.386	124.0	0.058	62.5	0.753	-32.5	0.539	20.40
0.8	0.611	-53.8	5.940	119.0	0.062	61.7	0.717	-34.9	0.600	19.78
0.9	0.576	-57.4	5.559	114.3	0.066	61.0	0.686	-37.1	0.667	19.26
1.0	0.546	-60.7	5.176	110.1	0.069	61.2	0.659	-39.0	0.728	18.74
1.1	0.516	-63.7	4.857	106.4	0.072	61.5	0.635	-40.5	0.789	18.29
1.2	0.495	-66.5	4.587	102.8	0.075	62.0	0.615	-41.9	0.839	17.88
1.3	0.470	-68.4	4.325	99.5	0.077	63.1	0.598	-43.0	0.895	17.47
1.4	0.454	-70.3	4.093	96.5	0.080	64.1	0.584	-44.1	0.937	17.07
1.5	0.435	-72.0	3.883	93.7	0.083	65.5	0.572	-45.0	0.977	16.68
1.6	0.421	-73.8	3.696	91.0	0.087	66.9	0.563	-45.8	1.006	15.81
1.7	0.407	-75.0	3.533	88.3	0.090	68.4	0.553	-46.4	1.035	14.78
1.8	0.395	-76.0	3.372	86.0	0.094	69.9	0.546	-47.1	1.061	14.05
1.9	0.386	-76.7	3.238	83.9	0.098	71.6	0.538	-47.8	1.073	13.53
2.0	0.375	-77.8	3.112	81.4	0.103	73.3	0.531	-48.2	1.086	13.02
2.1	0.364	-79.0	2.998	79.5	0.108	74.9	0.525	-48.7	1.092	12.58
2.2	0.353	-79.4	2.904	77.3	0.113	76.4	0.521	-49.4	1.095	12.21
2.3	0.349	-80.2	2.828	75.2	0.119	78.2	0.515	-49.8	1.085	11.98
2.4	0.341	-80.8	2.751	73.3	0.125	79.5	0.509	-50.4	1.084	11.67
2.5	0.335	-81.7	2.674	71.4	0.131	80.6	0.502	-51.4	1.078	11.39
2.6	0.326	-82.2	2.601	69.6	0.138	81.7	0.495	-52.6	1.073	11.09
2.7	0.319	-83.8	2.535	67.8	0.145	82.5	0.488	-53.7	1.065	10.86
2.8	0.311	-84.5	2.476	65.9	0.154	83.3	0.486	-54.9	1.049	10.72
2.9	0.304	-86.4	2.433	63.8	0.163	83.7	0.476	-56.1	1.035	10.60
3.0	0.298	-87.9	2.384	62.4	0.172	84.3	0.468	-58.1	1.018	10.59
4.0	0.288	-117.8	2.018	43.9	0.297	82.2	0.411	-83.8	0.836	8.33
5.0	0.388	-145.5	1.788	25.5	0.451	69.9	0.341	-119.5	0.737	5.98

$V_{CE} = 2\text{ V}$, $I_C = 5\text{ mA}$, $Z_O = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.830	-11.0	13.052	168.2	0.011	78.4	0.974	-7.5	0.195	30.85
0.2	0.780	-21.3	12.626	155.4	0.021	77.8	0.932	-14.5	0.244	27.69
0.3	0.732	-30.4	11.609	145.2	0.030	73.4	0.877	-20.2	0.337	25.90
0.4	0.667	-38.1	10.565	136.0	0.037	69.8	0.817	-24.8	0.443	24.57
0.5	0.612	-44.6	9.613	128.4	0.043	67.6	0.762	-28.3	0.533	23.50
0.6	0.563	-49.8	8.731	121.7	0.048	66.4	0.713	-31.0	0.616	22.56
0.7	0.519	-54.1	7.966	116.0	0.053	65.7	0.670	-33.2	0.694	21.77
0.8	0.480	-57.8	7.263	111.3	0.057	66.0	0.635	-34.8	0.761	21.04
0.9	0.448	-61.1	6.695	107.0	0.061	66.3	0.606	-36.1	0.819	20.38
1.0	0.425	-63.3	6.165	103.2	0.065	66.9	0.583	-37.2	0.870	19.75
1.1	0.399	-65.3	5.713	99.8	0.069	67.6	0.563	-38.2	0.922	19.18
1.2	0.383	-67.3	5.341	96.7	0.073	68.5	0.550	-39.0	0.953	18.65
1.3	0.365	-68.5	4.990	93.8	0.077	69.7	0.537	-39.7	0.989	18.11
1.4	0.351	-69.6	4.699	91.2	0.082	70.7	0.527	-40.3	1.012	16.94
1.5	0.339	-70.8	4.416	88.7	0.086	71.9	0.519	-40.8	1.037	15.94
1.6	0.329	-71.1	4.195	86.2	0.090	72.7	0.513	-41.3	1.051	15.28
1.7	0.322	-71.9	3.995	83.9	0.096	73.9	0.508	-41.6	1.058	14.74
1.8	0.312	-72.7	3.794	81.9	0.100	74.9	0.504	-41.9	1.070	14.16
1.9	0.307	-73.2	3.627	80.1	0.106	75.8	0.501	-42.5	1.069	13.73
2.0	0.303	-73.4	3.470	78.0	0.112	76.6	0.498	-42.7	1.072	13.28
2.1	0.299	-74.5	3.328	76.2	0.118	77.6	0.496	-43.1	1.068	12.92
2.2	0.290	-73.6	3.220	74.3	0.124	78.6	0.494	-43.6	1.067	12.57
2.3	0.288	-74.4	3.127	72.4	0.130	79.5	0.491	-44.0	1.056	12.34
2.4	0.283	-74.7	3.029	70.8	0.136	80.1	0.487	-44.5	1.055	12.03
2.5	0.279	-75.3	2.937	69.2	0.144	80.6	0.483	-45.3	1.047	11.77
2.6	0.273	-75.3	2.850	67.6	0.151	81.2	0.478	-46.2	1.044	11.48
2.7	0.272	-77.1	2.778	65.9	0.158	81.5	0.473	-47.4	1.034	11.32
2.8	0.265	-77.7	2.709	64.3	0.167	81.7	0.471	-48.4	1.023	11.18
2.9	0.261	-79.0	2.646	62.5	0.175	81.7	0.462	-49.5	1.018	10.98
3.0	0.255	-80.2	2.590	61.2	0.185	81.9	0.457	-51.5	1.003	11.13
4.0	0.250	-112.0	2.179	44.8	0.298	78.8	0.398	-75.1	0.867	8.64
5.0	0.354	-141.3	1.946	27.7	0.435	68.0	0.324	-105.7	0.776	6.50

$V_{CE} = 2\text{ V}$, $I_C = 7\text{ mA}$, $Z_O = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.783	-12.8	16.164	165.9	0.011	84.0	0.965	-8.7	0.145	31.77
0.2	0.716	-24.4	15.320	151.6	0.020	76.6	0.907	-16.2	0.308	28.77
0.3	0.651	-34.4	13.723	140.3	0.028	73.4	0.839	-22.0	0.413	26.85
0.4	0.586	-41.5	12.196	130.8	0.035	70.3	0.771	-26.1	0.535	25.43
0.5	0.529	-47.9	10.880	123.4	0.040	68.5	0.713	-29.1	0.631	24.31
0.6	0.479	-52.6	9.717	116.8	0.046	68.7	0.663	-31.2	0.712	23.28
0.7	0.436	-56.2	8.750	111.4	0.050	68.3	0.624	-32.8	0.788	22.40
0.8	0.404	-59.6	7.909	107.1	0.055	68.9	0.591	-33.8	0.846	21.58
0.9	0.377	-62.2	7.227	102.9	0.059	69.6	0.568	-34.7	0.893	20.85
1.0	0.356	-63.9	6.609	99.5	0.064	70.3	0.547	-35.4	0.940	20.15
1.1	0.337	-65.2	6.102	96.3	0.068	71.4	0.531	-36.1	0.973	19.50
1.2	0.323	-66.8	5.677	93.5	0.073	72.2	0.519	-36.7	0.997	18.89
1.3	0.310	-67.3	5.305	90.8	0.078	73.2	0.511	-37.1	1.020	17.47
1.4	0.301	-68.3	4.960	88.4	0.083	73.9	0.503	-37.5	1.038	16.58
1.5	0.289	-68.6	4.674	86.0	0.088	74.8	0.498	-38.0	1.049	15.89
1.6	0.282	-69.4	4.406	83.8	0.093	75.4	0.495	-38.4	1.060	15.26
1.7	0.276	-69.8	4.185	81.7	0.099	76.2	0.493	-38.7	1.062	14.75
1.8	0.273	-70.1	3.983	79.9	0.104	76.9	0.491	-39.0	1.065	14.28
1.9	0.270	-70.1	3.801	78.1	0.110	77.5	0.489	-39.5	1.063	13.85
2.0	0.266	-70.3	3.630	76.1	0.116	78.2	0.488	-39.7	1.062	13.42
2.1	0.263	-70.8	3.478	74.5	0.123	78.9	0.487	-40.1	1.058	13.05
2.2	0.261	-70.6	3.355	72.6	0.129	79.6	0.486	-40.6	1.052	12.75
2.3	0.259	-71.0	3.255	71.0	0.136	80.0	0.485	-41.0	1.043	12.52
2.4	0.255	-71.3	3.153	69.5	0.142	80.6	0.482	-41.5	1.039	12.24
2.5	0.254	-72.2	3.053	68.0	0.149	80.8	0.479	-42.3	1.033	12.00
2.6	0.249	-72.1	2.959	66.5	0.157	81.1	0.475	-43.4	1.028	11.73
2.7	0.248	-73.8	2.881	65.0	0.164	81.1	0.470	-44.4	1.020	11.56
2.8	0.243	-73.8	2.804	63.3	0.172	81.3	0.470	-45.4	1.012	11.44
2.9	0.241	-75.7	2.740	61.7	0.181	81.1	0.461	-46.5	1.005	11.36
3.0	0.238	-76.4	2.681	60.5	0.191	81.1	0.456	-48.5	0.993	11.48
4.0	0.232	-110.8	2.245	44.9	0.301	77.4	0.396	-71.5	0.876	8.73
5.0	0.338	-139.9	2.007	28.5	0.432	66.9	0.322	-99.6	0.793	6.67

$V_{CE} = 2\text{ V}$, $I_C = 10\text{ mA}$, $Z_O = 50\ \Omega$

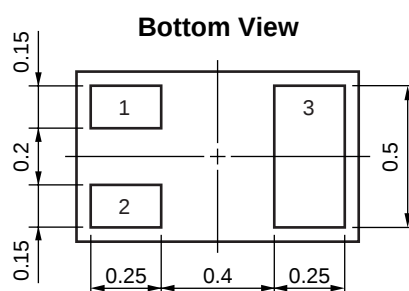
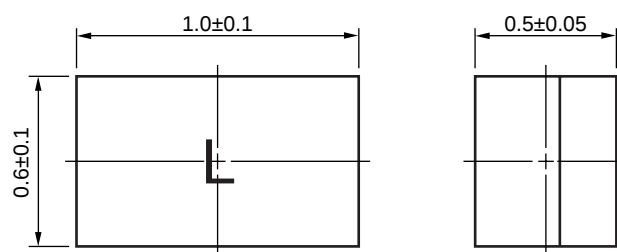
Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.718	-13.9	19.707	163.1	0.012	85.2	0.951	-9.9	0.192	32.08
0.2	0.643	-27.6	18.084	147.2	0.019	75.9	0.878	-17.8	0.382	29.75
0.3	0.568	-38.3	15.733	135.3	0.027	73.7	0.797	-23.3	0.498	27.67
0.4	0.497	-45.5	13.631	125.8	0.033	71.7	0.725	-26.9	0.624	26.19
0.5	0.443	-51.5	11.913	118.4	0.038	70.3	0.665	-29.2	0.725	24.96
0.6	0.397	-55.4	10.505	112.2	0.043	71.4	0.620	-30.4	0.799	23.84
0.7	0.362	-58.3	9.354	107.2	0.048	71.5	0.584	-31.4	0.866	22.87
0.8	0.336	-60.4	8.385	103.2	0.053	72.4	0.557	-32.1	0.914	21.97
0.9	0.312	-63.3	7.608	99.3	0.058	73.0	0.537	-32.7	0.949	21.14
1.0	0.294	-64.4	6.933	96.2	0.063	73.8	0.521	-33.0	0.984	20.39
1.1	0.279	-65.1	6.375	93.3	0.068	74.5	0.509	-33.7	1.011	19.06
1.2	0.271	-66.8	5.926	90.6	0.073	75.2	0.499	-34.1	1.024	18.11
1.3	0.260	-66.7	5.500	88.2	0.079	76.1	0.494	-34.6	1.040	17.21
1.4	0.255	-67.3	5.144	85.9	0.084	76.6	0.489	-34.9	1.049	16.50
1.5	0.249	-67.3	4.825	83.7	0.090	77.2	0.486	-35.4	1.056	15.85
1.6	0.244	-68.4	4.553	81.7	0.095	77.6	0.485	-35.8	1.059	15.30
1.7	0.240	-68.5	4.327	79.7	0.101	78.2	0.484	-36.2	1.056	14.85
1.8	0.237	-67.8	4.100	78.0	0.107	78.8	0.484	-36.4	1.060	14.33
1.9	0.236	-68.5	3.913	76.4	0.114	79.0	0.483	-36.9	1.055	13.94
2.0	0.234	-68.2	3.733	74.4	0.120	79.6	0.483	-37.3	1.052	13.53
2.1	0.234	-69.3	3.574	73.0	0.127	79.8	0.484	-37.7	1.046	13.19
2.2	0.233	-68.3	3.446	71.1	0.133	80.4	0.484	-38.2	1.041	12.88
2.3	0.233	-69.2	3.340	69.6	0.140	80.7	0.484	-38.6	1.030	12.70
2.4	0.231	-69.3	3.236	68.2	0.147	81.1	0.482	-39.2	1.025	12.46
2.5	0.231	-70.0	3.128	66.8	0.154	81.2	0.480	-40.0	1.019	12.22
2.6	0.230	-69.5	3.028	65.3	0.162	81.3	0.477	-41.0	1.016	11.95
2.7	0.227	-71.4	2.945	64.0	0.170	81.2	0.472	-42.1	1.007	11.86
2.8	0.223	-72.5	2.866	62.5	0.178	81.3	0.472	-43.1	0.999	12.07
2.9	0.223	-73.9	2.800	60.8	0.187	80.9	0.463	-44.4	0.993	11.76
3.0	0.217	-75.1	2.735	59.7	0.196	80.9	0.458	-46.4	0.984	11.45
4.0	0.218	-110.9	2.291	44.7	0.305	76.7	0.399	-69.1	0.877	8.76
5.0	0.327	-141.3	2.048	28.7	0.433	66.1	0.324	-95.9	0.800	6.75

$V_{CE} = 2\text{ V}$, $I_C = 20\text{ mA}$, $Z_O = 50\ \Omega$

Frequency (GHz)	S ₁₁		S ₂₁		S ₁₂		S ₂₂		K	MAG/MSG (dB)
	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)	MAG.	ANG. (deg.)		
0.1	0.545	-20.8	25.651	157.0	0.010	80.4	0.908	-12.1	0.365	34.01
0.2	0.450	-39.6	21.847	138.0	0.017	76.6	0.802	-20.2	0.537	30.98
0.3	0.379	-50.6	17.763	125.3	0.024	75.6	0.710	-24.1	0.681	28.64
0.4	0.318	-59.3	14.689	116.3	0.029	73.8	0.643	-26.0	0.808	26.99
0.5	0.276	-65.8	12.450	109.5	0.035	74.2	0.596	-26.8	0.885	25.52
0.6	0.247	-69.8	10.734	104.1	0.041	76.0	0.562	-27.2	0.939	24.23
0.7	0.222	-74.0	9.430	99.7	0.046	76.7	0.538	-27.5	0.984	23.16
0.8	0.207	-76.4	8.356	96.2	0.051	77.8	0.519	-28.0	1.012	21.43
0.9	0.194	-79.0	7.530	93.1	0.057	78.5	0.508	-28.4	1.029	20.15
1.0	0.184	-80.3	6.823	90.3	0.063	79.1	0.498	-28.9	1.050	19.00
1.1	0.176	-80.9	6.248	87.6	0.068	79.8	0.493	-29.5	1.060	18.11
1.2	0.173	-82.7	5.790	85.3	0.074	80.4	0.488	-30.1	1.061	17.41
1.3	0.166	-82.7	5.356	83.1	0.080	80.9	0.487	-30.9	1.068	16.65
1.4	0.165	-83.1	4.997	80.9	0.086	81.3	0.485	-31.6	1.069	16.03
1.5	0.160	-83.3	4.687	79.1	0.093	81.7	0.486	-32.3	1.066	15.47
1.6	0.160	-83.2	4.417	77.1	0.099	82.0	0.486	-33.0	1.063	14.97
1.7	0.160	-83.7	4.181	75.1	0.105	82.3	0.488	-33.7	1.055	14.54
1.8	0.159	-83.3	3.971	73.6	0.112	82.6	0.490	-34.3	1.051	14.12
1.9	0.160	-83.1	3.785	72.1	0.119	82.7	0.491	-35.0	1.041	13.78
2.0	0.159	-83.1	3.608	70.3	0.126	83.1	0.493	-35.5	1.034	13.42
2.1	0.161	-83.1	3.453	68.8	0.134	83.2	0.494	-36.3	1.026	13.13
2.2	0.158	-82.8	3.329	67.1	0.141	83.5	0.496	-37.1	1.016	12.95
2.3	0.159	-83.1	3.225	65.6	0.149	83.6	0.496	-37.7	1.005	12.91
2.4	0.159	-84.0	3.121	64.2	0.157	83.9	0.495	-38.6	0.996	13.00
2.5	0.160	-84.1	3.019	62.9	0.165	83.7	0.494	-39.7	0.989	12.63
2.6	0.159	-84.9	2.921	61.4	0.173	83.7	0.490	-41.0	0.983	12.27
2.7	0.159	-87.1	2.845	60.0	0.182	83.4	0.488	-42.2	0.973	11.95
2.8	0.156	-88.5	2.769	58.5	0.191	83.2	0.486	-43.5	0.964	11.62
2.9	0.155	-90.6	2.700	57.0	0.201	82.6	0.478	-45.1	0.959	11.29
3.0	0.153	-92.7	2.636	55.8	0.211	82.5	0.475	-47.2	0.948	10.96
4.0	0.200	-136.8	2.203	40.5	0.332	76.6	0.416	-73.1	0.839	8.22
5.0	0.341	-160.3	1.965	24.1	0.473	64.4	0.343	-104.4	0.768	6.19

PACKAGE DIMENSIONS

3-PIN NON-LEAD MINIMOLD (UNIT: mm)



PIN CONNECTIONS

1. Emitter
2. Base
3. Collector

[MEMO]

[MEMO]

[MEMO]

- **The information in this document is current as of December, 2000. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC's data sheets or data books, etc., for the most up-to-date specifications of NEC semiconductor products. Not all products and/or types are available in every country. Please check with an NEC sales representative for availability and additional information.**
- No part of this document may be copied or reproduced in any form or by any means without prior written consent of NEC. NEC assumes no responsibility for any errors that may appear in this document.
- NEC does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from the use of NEC semiconductor products listed in this document or any other liability arising from the use of such products. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC or others.
- Descriptions of circuits, software and other related information in this document are provided for illustrative purposes in semiconductor product operation and application examples. The incorporation of these circuits, software and information in the design of customer's equipment shall be done under the full responsibility of customer. NEC assumes no responsibility for any losses incurred by customers or third parties arising from the use of these circuits, software and information.
- While NEC endeavours to enhance the quality, reliability and safety of NEC semiconductor products, customers agree and acknowledge that the possibility of defects thereof cannot be eliminated entirely. To minimize risks of damage to property or injury (including death) to persons arising from defects in NEC semiconductor products, customers must incorporate sufficient safety measures in their design, such as redundancy, fire-containment, and anti-failure features.
- NEC semiconductor products are classified into the following three quality grades:
 "Standard", "Special" and "Specific". The "Specific" quality grade applies only to semiconductor products developed based on a customer-designated "quality assurance program" for a specific application. The recommended applications of a semiconductor product depend on its quality grade, as indicated below. Customers must check the quality grade of each semiconductor product before using it in a particular application.
 "Standard": Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots
 "Special": Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)
 "Specific": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.
 The quality grade of NEC semiconductor products is "Standard" unless otherwise expressly specified in NEC's data sheets or data books, etc. If customers wish to use NEC semiconductor products in applications not intended by NEC, they must contact an NEC sales representative in advance to determine NEC's willingness to support a given application.
 (Note)
 (1) "NEC" as used in this statement means NEC Corporation and also includes its majority-owned subsidiaries.
 (2) "NEC semiconductor products" means any semiconductor product developed or manufactured by or for NEC (as defined above).